

MINISTRY OF EDUCATION AND RESEARCH



TECHNICAL UNIVERSITY
OF CLUJ-NAPOCA

CGIS
Computer Graphics
and Interactive Systems

TUC-N Research on Satellite Image Processing over Distributed Infrastructures

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- Computer Graphics and Interactive Systems Laboratory (CGIS) carry out research in computer graphics, Grid and Cloud computing, spatial data modeling and processing, distributed interactive systems, graphic cluster based processing
- Develops Grid and Cloud oriented applications and platforms:
GreenLand, ESIP, gProcess, eGLE, gSWAT, gSWATSim,
GreenView, Waterland, and Minerals applications

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Specific Objectives

- Explore huge spatial data (i.e. satellite images) to supply information on the earth surface, weather, climate, geographic areas, pollution, and natural phenomena
- Support many variables based processing - satellite image type (e.g. MODIS, Landsat), geographic area, soil composition, vegetation cover, season, and context (e.g. clouds)
- Develop tools and components to support the development of Grid and Cloud oriented EO (Earth Observation) applications
- Develop and experiment the EO Application Development Methodology
- Flexible description, instantiation, scheduling and optimal execution of the Grid and Cloud processing

Grid Related Projects



- [EnviroGRIDS](#), Black Sea Catchment Observation and Assessment System supporting Sustainable Development, FP7 project, co-funded by the European Commission (2009 - 2013).



- [GiSHEO](#), On demand Grid services for high education and training in Earth Observation, ESA-PECS project , Funded by European Space Agency through PECS Programme (2008-2010).



SEE-GRID-SCI
SEE-GRID eInfrastructure for regional eScience

- [SEE-GRID-SCI](#), SEE-GRID eInfrastructure for regional eScience, FP7 project, co-funded by the European Commission (2008 - 2010).



- [MEDIOGRID](#), Parallel and distributed graphical processing on grid structure of geographical and environmental data. CEEX National Project (2005-2008).

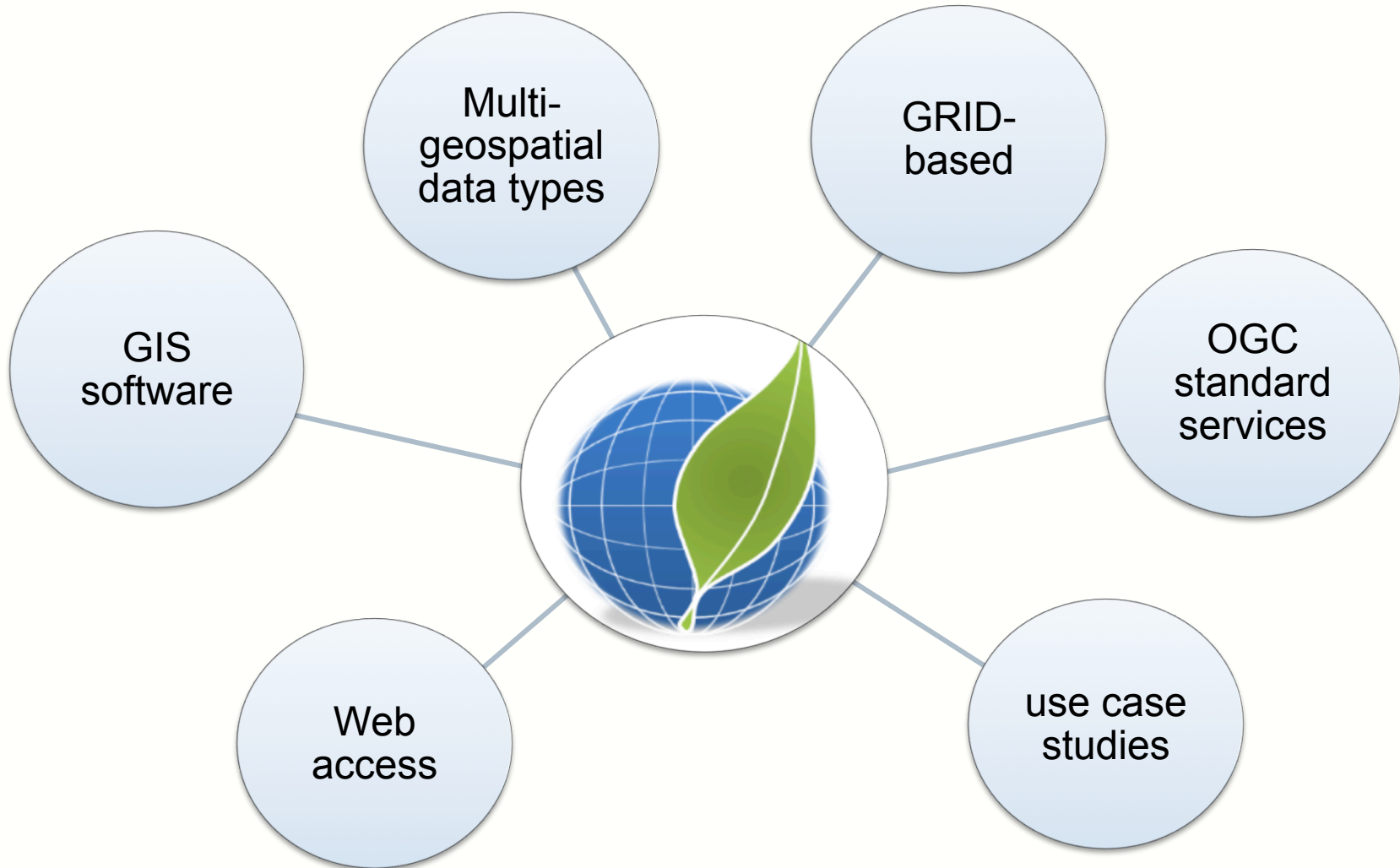
High Performance Computation

- Distributed computer network
- High power Computation
- Large storage capabilities

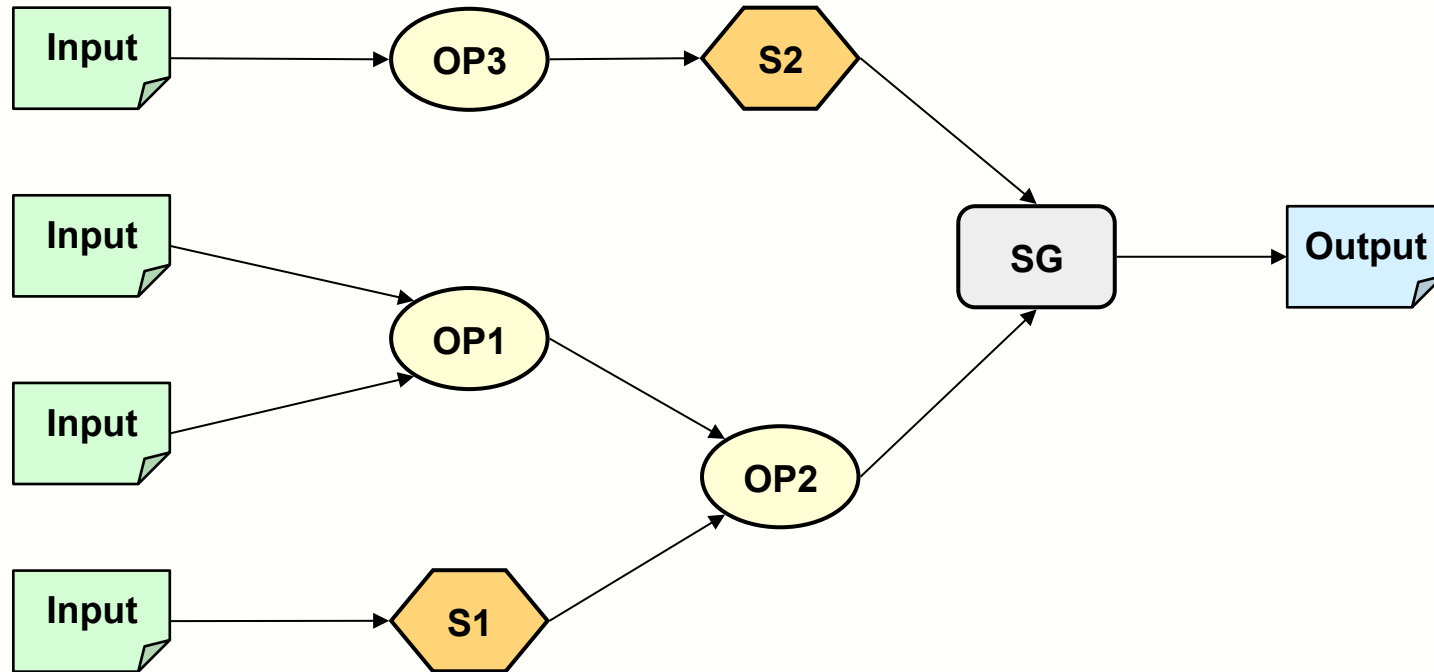


- Optimize execution time
- Processing of large volume of data

GreenLand Application



Hypergraphs – Process Description Graph



The hypergraph is a complex graph that combines operators (OP), services (S) and subgraphs (SG). The subgraph could be a simple or complex graph.

Inputs: Spectral bands in satellite images – MODIS, Landsat, QuickBird, etc

OP examples: Add, Subtract, Blur, Sharpen, EdgeDetection, HistogramEq, PseudoColoring, Erosion, etc.

Architecture of GreenLand Application

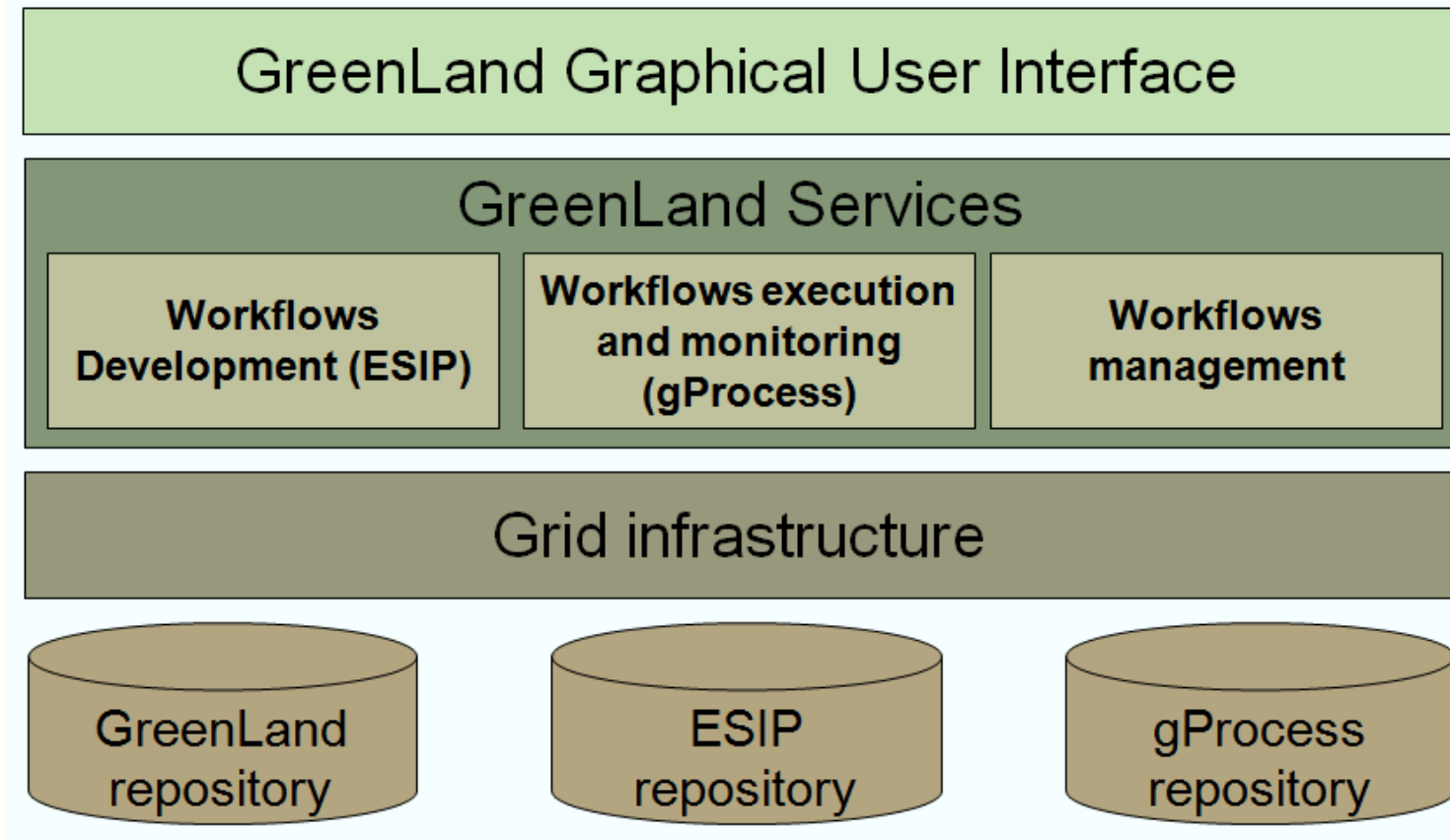
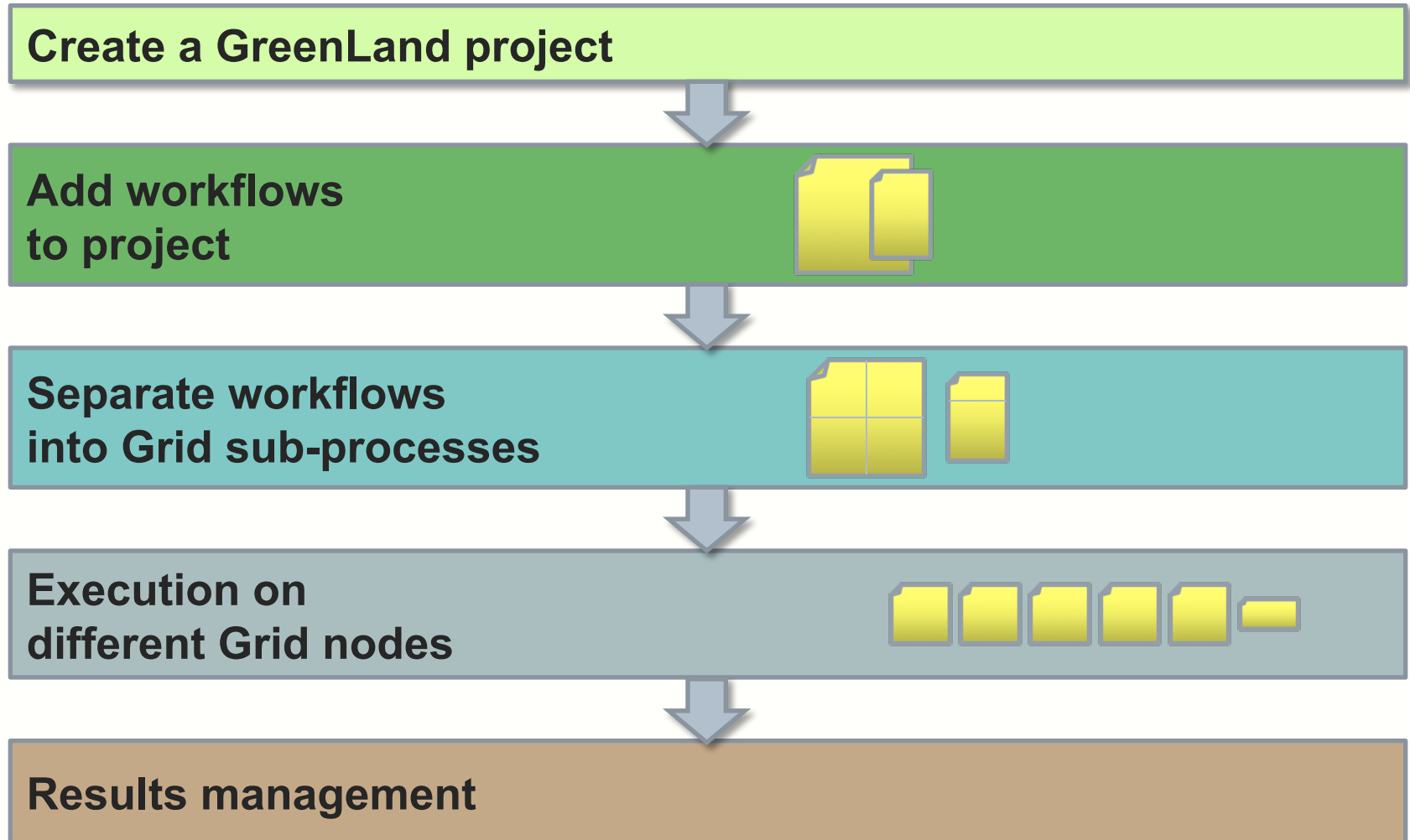
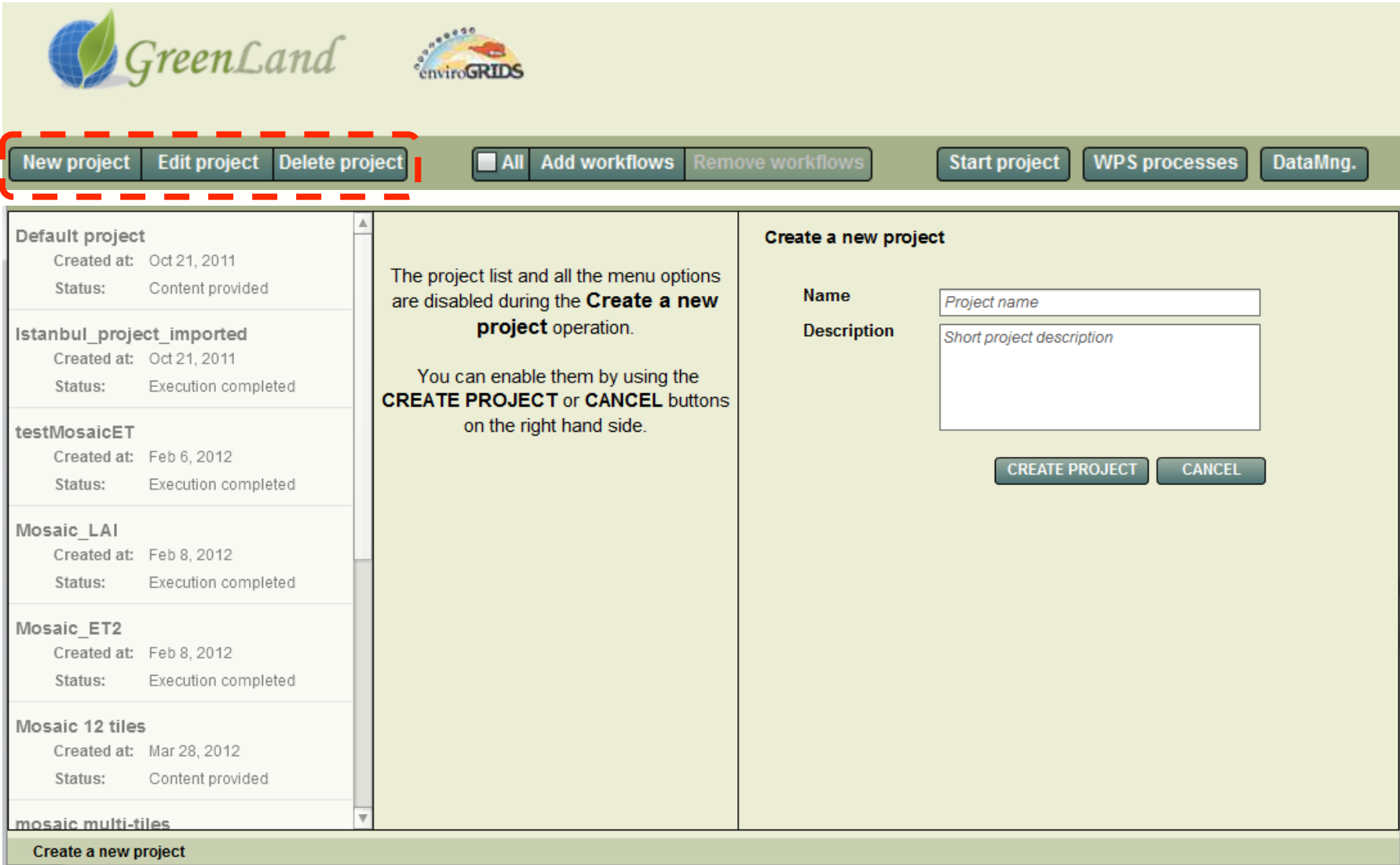


Image Processing Life Cycle



GreenLand Application



The image shows the GreenLand application interface. At the top left is the GreenLand logo, and next to it is the enviroGRIDS logo. Below these logos is a toolbar with several buttons: 'New project', 'Edit project', 'Delete project', 'All', 'Add workflows', 'Remove workflows', 'Start project', 'WPS processes', and 'DataMng.'. The 'New project', 'Edit project', and 'Delete project' buttons are highlighted with a red dashed border. Below the toolbar is a main content area divided into three sections. On the left is a list of projects with their creation dates and statuses. In the center is a text box explaining that menu options are disabled during the 'Create a new project' operation and can be re-enabled using 'CREATE PROJECT' or 'CANCEL' buttons. On the right is a form for creating a new project, including fields for 'Name' and 'Description', and 'CREATE PROJECT' and 'CANCEL' buttons.

GreenLand enviroGRIDS

New project **Edit project** **Delete project** All **Add workflows** **Remove workflows** **Start project** **WPS processes** **DataMng.**

Project Name	Created at	Status
Default project	Oct 21, 2011	Content provided
Istanbul_project_imported	Oct 21, 2011	Execution completed
testMosaicET	Feb 6, 2012	Execution completed
Mosaic_LAI	Feb 8, 2012	Execution completed
Mosaic_ET2	Feb 8, 2012	Execution completed
Mosaic 12 tiles	Mar 28, 2012	Content provided
mosaic multi-tiles		

Create a new project

The project list and all the menu options are disabled during the **Create a new project** operation.

You can enable them by using the **CREATE PROJECT** or **CANCEL** buttons on the right hand side.

Name

Description

CREATE PROJECT **CANCEL**

Create a new project

WPS Service Processing

The screenshot displays the WPS Service Processing interface. At the top, there are logos for GreenLand and enviroGRIDS. Below the logos is a navigation bar with buttons: 'New project', 'Edit project', 'Delete project', 'All', 'Add workflows', 'Remove workflows', 'Start project', 'WPS processes', and 'DataMng.'. The 'WPS processes' button is highlighted with a red dashed box. The main area is divided into two panels. The left panel shows 'Available processes' with 'NDVI' selected, its description 'Computes the NDVI index.', project name 'NDVI_from_WPS', and project description 'Execute the NDVI using WPS'. The right panel shows 'Available processes' with 'AccuracyAssessment' selected, its description 'Computes the Kappa statistics for the classified image.', project name 'Accuracy_assessment_from_WPS', and project description 'Execute the Accuracy assessment using WPS'. To the right of the right panel is a section titled 'Specify the selected process inputs' with an information icon. It lists three inputs: 1. Description: Shapefile (shp), Type: vector/shp, Value: Istanbul_bnd.shp/Istanbul_bnd.shp; 2. Description: Shapefile index (shx), Type: vector/shx, Value: Istanbul_bnd.shx/Istanbul_bnd.shx; 3. Description: Shape DataBase file (dbf), Type: vector/dbf, Value: Istanbul_bnd.dbf/Istanbul_bnd.dbf. A 'Start process' button is located at the bottom right of the right panel.

OGC Service Oriented Architecture

Data management window

Url for the OGC service

http://129.194.231.213:8080/geoserver/ows

Connect

Data management window

Url for the OGC service

http://129.194.231.213:8080/geoserver/ows

Connect

Data management window

Url for the OGC service

http://129.194.231.213:8080/geoserver/ows

Connect

Service version

1.0.0

Layers

Urban population at subnational le

Image width

1000

Image height

500

Coordinates points of the selection

A: 14.999799602476664

B: 14.999799602476664

C: 43.82792460247666

D: 43.82792460247666 54.81131097560788

The geographical selection will ALWAYS have a rectangular shape based on the min. and max. latitude and longitude values of these points!

Use this name when saving the image

Urban_population

Use this privacy attribute when saving the image

Private use

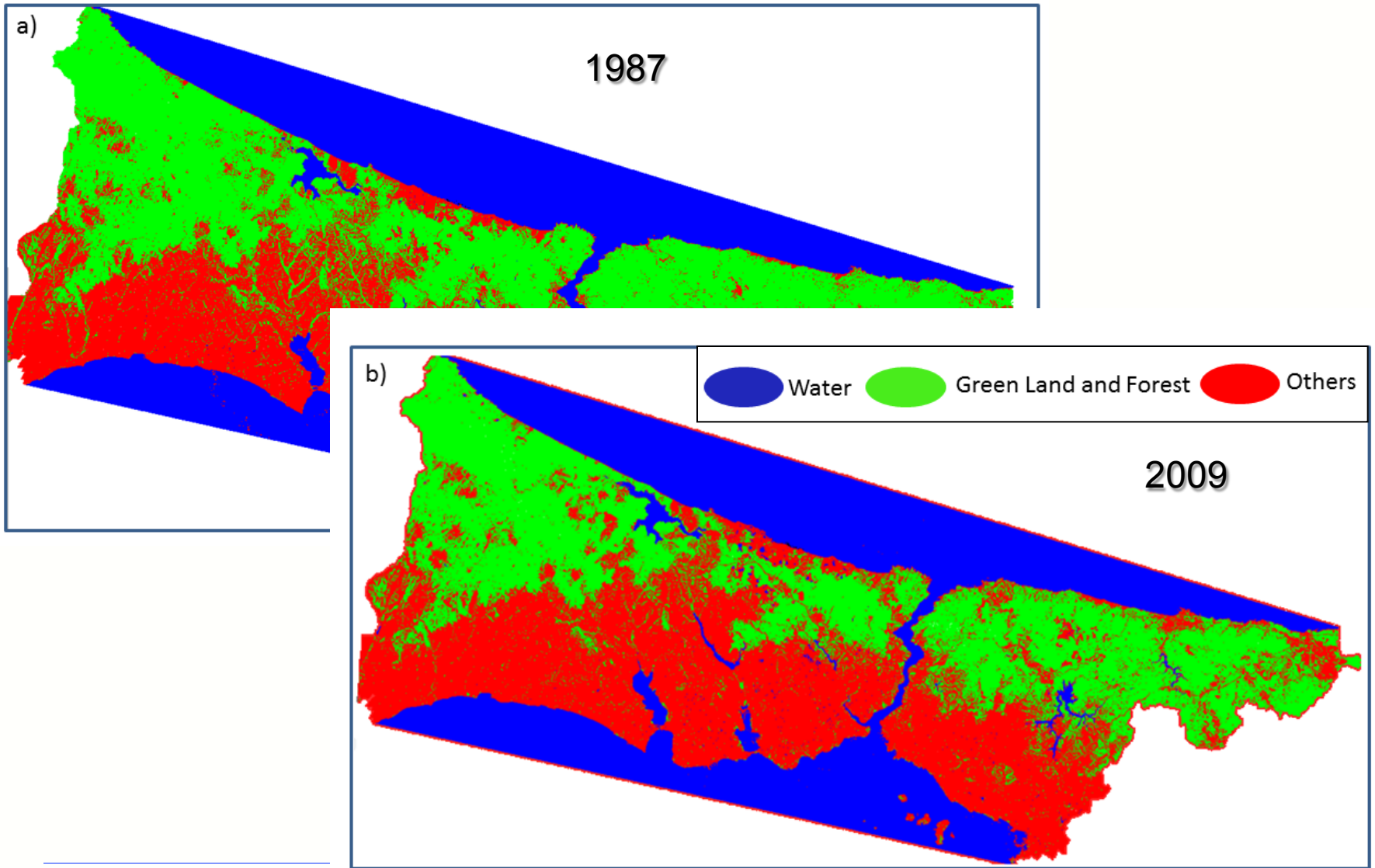
Save image to GreenLand repository

Cancel

Upload to GreenLand repository

POWERED BY esri

EVI – Enhanced Vegetation Index



References

- Gorgan D., Bacu V., Stefanut T., Rodila D., Mihon D., Earth Observation application development based on the Grid oriented ESIP satellite image processing platform, *Journal of Computer Standards & Interfaces*, Vol. 34/6, Nov. 2012, pp. 541–548 (2012).
- Rodila D., Gorgan D., Geospatial and Grid Interoperability through OGC Services Gridification, in *International Journal of Selected Topics in Applied Earth Observations and Remote Sensing – JSTARS*, Vol. 5/6, pp. 1650-1658, (2012).
- Gorgan D., Bacu V., Mihon D., Stefanut T., Rodila D., Cau P., Abbaspour K., Giuliani G., Ray N., Lehmann A., Software platform interoperability throughout enviroGRIDS portal, in *International Journal of Selected Topics in Applied Earth Observations and Remote Sensing – JSTARS*, Vol. 5/6, pp. 1617-1627, (2012).
- Gorgan, D., Bacu, V., Mihon, D., Rodila, D., Abbaspour, K., and Rouholahnejad, E.: Grid based calibration of SWAT hydrological models, *Journal of Natural Hazards and Earth System Sciences (NHES)*, Vol. 12/7, pp. 2411-2423, (2012).